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# TRIADIC INSTRUCTION OF CHAINED FOOD PREPARATION RESPONSES: ACQUISITION AND OBSERVATIONAL LEARNING

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This research examined whether constant time delay would be effective in teaching students with moderate mental retardation in triads to perform chained tasks and whether observational learning would occur. Three chained snack preparation tasks were identified, and each student was directly taught one task. The other 2 students observed the instruction. The instructed student told the observers to watch and to turn pages of a pictorial recipe book. The teacher provided frequent praise to the instructed student based on performance and to the observers for watching the instruction and turning pages. A multiple probe design across students and tasks was used to evaluate the instruction. The results indicated that each student learned the skill he or she was taught directly, and the observers learned nearly all of the steps of the chains they observed. The implications for classroom instruction and future research in observational learning are discussed.

DESCRIPTORS: chained tasks, constant time delay, food/snack preparation, mentally retarded, observational learning

The curriculum for students with moderate mental retardation should focus on skills that increase their independence in community living (Snell, 1987; Wolery, Ault, & Doyle, 1992). Examples of these skills include dressing and undressing, janitorial skills, purchasing goods and services in the community, and using public transportation. Cooking skills and snack preparation are critical skills for independent living and may lead to vocational opportunities (Schuster, 1988). Many of these skills are chained tasks requiring performance of a number of separate behaviors sequenced together to form a complex skill.

Current instructional practices suggest that chained tasks should be taught using a total-task presentation format within naturally occurring routines (Kayser, Billingsley, & Neel, 1986). The system of least prompts (increasing assistance) traditionally has been used to teach response chains (Doyle, Wolery, Ault, & Gast, 1988). The system of least prompts uses a hierarchy of prompts ordered from the least to most intrusive. On each trial, the student is presented with an opportunity to perform without prompts; if no response or an error occurs, the student is presented with the least intrusive prompt and a response interval; again, if no response or an error occurs, the student is presented with the next level of prompt and a response interval; this process continues until a correct response occurs.

The constant time delay procedure also has been

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used to teach skills to students with mental retardation. The constant time delay uses one controlling prompt delivered initially in 0-s delay trials (i.e., immediately after the presentation of the discriminative stimulus); in subsequent trials, the prompt is withheld for a fixed and specified length of time after delivery of the discriminative stimulus. Schuster, Gast, Wolery, and Guiltinan (1988) used constant time delay in a one-to-one arrangement to teach 4 students with moderate mental retardation three chained cooking skills. McDonnell (1987) compared constant time delay and the system of least prompts in one-to-one instruction in teaching chained tasks to students with severe mental retardation. Both procedures were effective, but constant time delay was more efficient. Similarly, Wolery, Ault, Gast, Doyle, and Griffen (1990) compared constant time delay and the system of least prompts in one-to-one instruction in teaching chained tasks to students with moderate mental retardation. As in McDonnell's study, both procedures were effective, but constant time delay resulted in more rapid learning.

Although the results of these studies are encouraging, the use of one-to-one instruction presents logistical problems for classroom teachers. Research with discrete tasks indicates that many students with moderate mental retardation can learn in small-group instruction (Collins, Gast, Ault, & Wolery, 1991). In addition to solving logistical problems and saving time for teachers, small-group instruction provides an opportunity for observational learning (i.e., students can learn skills taught to other students).

Recently, investigators have attempted to teach chained tasks in small-group contexts, specifically in dyads. Schoen, Lentz, and Suppa (1988) compared decreasing assistance and graduated guidance in teaching children face washing and fountain drinking. One child in the dyad was taught the chain and the other member observed the instruction. The teacher cued the observer to watch the instruction and provided reinforcement for watching. Both prompting procedures were effective, and the observer also learned the skills. Schoen and Sivil (1989) compared time delay and the system of least prompts in teaching children to get a drink and make a snack. As in the Schoen et al. study, 1 child was taught the chains while the other child observed. The observer was instructed by the teacher to watch the instruction and was reinforced for doing so. Both procedures were effective, but time delay was more efficient. Interestingly, the observer also learned many components of the task. Wolery, Ault, Gast, Doyle, and Griffen (1991) taught students with moderate mental retardation chained tasks in dyads using constant time delay. However, unlike the studies by Schoen et al. and Schoen and Sivil, each student was taught half the skill and observed the other half. Also, the teacher did not cue or reinforce observation; however, she prompted the instructed student to cue the observer at the beginning of the chain to watch. Programmed contingencies for observing were not in effect. Students learned their portions of the response chain and learned substantial portions of the chain they observed.

The purpose of this investigation was two-fold. First, the study sought to determine whether constant time delay would be effective in teaching chained tasks in triads. Second, the study focused on whether observational learning would occur when 2 students served as observers and did not receive direct instruction.

## METHOD

### *Participants and Setting*

The participants in this study were 3 students (1 male, 2 female) with moderate mental retardation. They were enrolled in a self-contained classroom in an elementary school (grades K–6). All students were diagnosed as having Down syndrome. Colin (age 13 years, 8 months) wore a hearing aid to correct a unilateral moderate hearing loss. Testing with the Stanford-Binet Intelligence Scale (Terman & Merrill, 1973) yielded an IQ score of 33 and a mental age of 3 years, 1 month. Colin spoke in two- to three-word phrases, but articulation errors affected speech intelligibility. Colin read some food words, sorted laundry, and wrote

job application information, but was unable to count change, tie shoes, or determine which item cost less. Alma (age 12 years, 8 months) received an IQ score of 42 and a mental age of 4 years, 4 months on the Stanford-Binet. Alma spoke in two- to five-word phrases. She could read most food and recipe direction words and identified all coins and coin values, read monetary amounts to $100.00, and used dollar bills to purchase items totaling less than $20. Alma could read Dolch words at the second- and third-grade level and could set a table, but was unable to tie shoes, pack a suitcase, or use a can opener. Andrea (age 10 years, 11 months) had an IQ score of 37 and a mental age of 3 years, 8 months on the Stanford-Binet. Andrea could write her name and address, read some food and recipe direction words, and wash dishes, but could not count varying monetary amounts or tell time in 5-min intervals.

All of the students demonstrated mastery of the prerequisite skills necessary for learning the chained tasks. These included adequate visual acuity to see the stimulus materials, auditory acuity, ability to imitate simple motor movements, volitional motor control, ability to stay on task for 15 to 20 min in a group setting, ability to wait for a prompt, and the ability to choose a reinforcer. All students could receptively identify all materials used in the response chains taught in this study. Prerequisite skills were assessed during instructional activities. The ability to stay on task was observed for a variety of activities, and the ability to select a reinforcer was assessed with a reinforcement menu. Students demonstrated a consistent wait response in discrete-trial group settings (e.g., reading tasks) as well as individual chained-task settings (e.g., setting the table). Volitional motor control and imitating motor movements were assessed through activities such as making Kool-Aid®, washing dishes, and folding clothes.

Sessions were conducted in the student's classroom (6.4 m by 8.8 m) by the classroom teacher. Materials were placed on a rectangular table (1.5 m by 0.7 m) and on shelves (0.9 m by 2.4 m) at one end of the table. A small refrigerator and garbage can were placed at the end of the table near the shelves. Three dishpans and a dish drainer placed on two student desks were used for washing, rinsing, and draining dishes. Appliances needed (e.g., blender) were placed on the table. This work area was located in one corner of the classroom and was typically used for chained tasks such as setting the table, folding napkins, and snack preparation.

### *Chained Tasks and Materials*

Three chained snack preparation tasks were selected for instruction: making a milkshake, scrambled eggs, and pudding. The task analyses and materials for each are shown in Table 1. Instant pudding mix was used to allow students to eat it immediately. A teacher-designed pictorial recipe was used with each skill. Each page of the recipe contained words describing the step, black-and-white line drawings illustrating the words, and the words "turn the page" with an arrow indicating the next page at the bottom right-hand corner. Multiple exemplars and distractors of all utensils, measuring cups, and bowls were always present to replicate a typical kitchen. Tokens from the classroom management system were used to reinforce students for participating in probe sessions, for the instructed student for completing the response chain during instructional sessions, and for the observing students for turning pages of the recipe book and watching the instruction. Back-up reinforcers included eating the prepared food (natural consequence of food preparation) or other small items usually available in the classroom.

### *Procedure*

*General procedures.* A 5-s constant time delay (CTD) procedure was used in two daily single-trial sessions with a total task presentation to teach the chained responses. Criterion for each task was one session of 100% independent correct responses using a continuous reinforcement schedule (CRF), one session of 100% independent correct responses with an average of every two steps being reinforced (variable-ratio [VR] 2), one session of 100% independent correct responses using a VR schedule for one fourth of the task steps, and one session of 100% independent correct responses with reinforcement

Table 1
Task Analyses for Making a Milkshake, Scrambled Eggs, and Pudding

| Skill | Steps in the task analysis | | Materials |
|---|---|---|---|
| Milkshake | 1. Put book on table | 15. Put lid on blender | Pictorial recipe |
| | 2. Get chocolate | 16. Push blend button | Powdered chocolate |
| | 3. Get ice cream scoop | 17. Blend together/count to 10 | Ice cream scoop |
| | 4. Get 1 tablespoon | 18. Turn blender off | 1 tablespoon |
| | 5. Get 1 cup | 19. Take lid off | 1 cup |
| | 6. Get 3 glasses | 20. Pour milkshake in 3 glasses | 3 glasses |
| | 7. Get milk from refrigerator | 21. Close ice cream | Carton of milk |
| | 8. Get ice cream from freezer | 22. Put ice cream in freezer | Ice cream |
| | 9. Open milk | 23. Close milk | Blender |
| | 10. Pour 2 cups milk in blender | 24. Put milk in refrigerator | Dishpan |
| | 11. Open ice cream | 25. Close chocolate | Refrigerator |
| | 12. Add 2 scoops ice cream | 26. Put chocolate on shelf | Dish towels |
| | 13. Open chocolate | 27. Put tablespoon/cup/scoop in dishpan | |
| | 14. Add 1 tablespoon chocolate | 28. Put blender/lid in dishpan | |
| Scrambled eggs | 1. Put book on table | 14. Put whisk on bottom of bowl | Pictorial recipe |
| | 2. Get eggs/milk/butter | 15. Beat till blended/count to 10 | Carton of eggs |
| | 3. Get mixing bowl/spatula | 16. Cut butter with knife | Carton of milk |
| | 4. Get whisk/knife | 17. Put butter in skillet with knife | Butter |
| | 5. Get ¼ cup | 18. Spread butter with spatula | Mixing bowl |
| | 6. Get 3 plates | 19. Pour eggs in skillet | Spatula |
| | 7. Open egg carton | 20. Stir eggs with spatula/count to 10 | Whisk |
| | 8. Crack 2 eggs in bowl | | Knife |
| | 9. Put shells in garbage can | 21. Turn skillet off | ¼ cup |
| | 10. Open milk | 22. Put eggs on 3 plates | 3 plates |
| | 11. Add ¼ cup milk | 23. Put eggs/milk/butter in refrigerator | Electric skillet |
| | 12. Close milk | | Garbage can |
| | 13. Turn skillet to 300 degrees | 24. Put knife/spatula/whisk/cup in bowl | Dishpan |
| | | | Refrigerator |
| | | 25. Put bowl in dishpan | Dish towel |
| Pudding | 1. Put book on table | 13. Mix together/count to 10 | Pictorial recipe |
| | 2. Get pudding mix | 14. Turn mixer off | Pudding mix |
| | 3. Get mixing bowl/spatula | 15. Put mixer on table | Mixing bowl |
| | 4. Get 1 cup | 16. Scrape bowl with spatula | Spatula |
| | 5. Get 3 serving bowls | 17. Put pudding in 3 bowls | 1 cup |
| | 6. Get milk from refrigerator | 18. Close milk | 3 serving bowls |
| | 7. Open milk | 19. Put milk in refrigerator | Carton of milk |
| | 8. Pour 2 cups milk in bowl | 20. Take beaters out | Electric mixer |
| | 9. Open pudding mix | 21. Put beaters/spatula/cup in bowl | Garbage can |
| | 10. Add pudding mix | | Dishpan |
| | 11. Put beaters on bottom of bowl | 22. Put bowl in dishpan | Refrigerator |
| | 12. Turn mixer on mix | 23. Put trash in garbage can | Dish towels |

*Note.* Page-turning steps were inserted where appropriate.

provided only on the last step in the chained task. Reinforcement for attending also was delivered to the observers on the same schedule. Individual probe sessions were conducted that gave the student an opportunity to complete each step of the task analysis. During training sessions, the student being taught directed the observing students to turn the pages of the recipe book. This was done to increase attention to the task under instruction.

*Probe procedures.* Individual probe sessions were conducted before instruction and after the target student performed at criterion level on each task.

Before implementing instruction on the first task, probe sessions were conducted for a minimum of three sessions with all students. Upon reaching criterion, probe sessions were conducted for all students on all three tasks. Correct responses were recorded when the student initiated a correct response within 5 s and completed the response within 25 s. For selected steps, longer completion intervals were allowed. Incorrect responses were recorded in the following response categories: topography errors, duration errors, sequence errors, and no-response errors. Topography errors occurred when responses were initiated (within 5 s) but incorrectly completed. Duration errors occurred when responses were correctly initiated but not completed within the response interval. Sequence errors occurred when a correct step was performed in any order other than that specified in the task analysis. No-response errors occurred when students did not initiate a response within 5 s.

During probe trials, the students were allowed to use the pictorial recipe books. The student was asked if he or she was ready to work. After an affirmative response, the task direction "Make the __" was presented. Correct responses resulted in verbal praise from the teacher. Incorrect responses resulted in the teacher correcting the materials while unobserved by the student (i.e., by working behind a screen or by turning the child around), presenting the corrected materials to the student, delivering the task direction "Make the __," and allowing the student to continue with the next step of the response chain. Students were praised on a VR 3 schedule for attending. Tokens were presented at the end of the session, and the student selected a back-up reinforcer.

*Constant time delay procedures.* One session was conducted at a 0-s delay interval with all remaining sessions at a 5-s delay interval. The controlling prompt was a teacher model and verbal description of the step. During the 0-s trials, the teacher asked all students if they were ready to work; upon receiving an affirmative response, she prompted the target student to say "watch me" to the observers. The teacher said, "Make the __", delivered the prompt for the first step, and provided a 5-s response interval. She recorded the response, provided the consequences, and delivered the prompt for the next step. This sequence was used for all remaining steps in the chain. The teacher praised the target student with descriptive verbal praise (e.g., "Good, you opened the milk") for each step of the task analysis, and the observing students were praised for attending (e.g., "Good looking"). Praise for the step of turning the pages of the recipe book was delivered to the target student using an observing student's name (e.g., "Great, you told __ to turn the page when you got finished"). Praise for attending to these steps was delivered to the other observer using that student's name (e.g., "__, you are really looking"). Upon completion of the chained task, one observer was prompted to praise the target student for task completion and the other observer was prompted to give a token to the target student. The observers were praised and given tokens by the teacher. Thus, all students received tokens. Tokens were exchanged for back-up reinforcers (e.g., opportunity to consume the snack that was prepared, other small edibles, and trinkets).

The 5-s delay trials were conducted using the same procedures as the 0-s trials with the addition of a 5-s response interval before the controlling prompt was delivered. The delay provided the opportunity for the following responses: correct anticipations, correct waits, nonwait errors, wait errors, and no-response errors. Correct anticipation responses were those initiated and completed within the response interval and before the controlling prompt. Correct wait responses were those initiated after the prompt and completed within the response interval. Nonwait errors were those initiated before the prompt but incorrectly completed or those that included a step performed out of sequence in the task analysis. Wait errors were those that occurred after the prompt. Errors were scored as errors of topography, duration, or sequence as defined above. No-response errors were scored when a student did not initiate a response within 5 s of the prompt. When errors occurred, the student was interrupted.

The teacher provided a model and verbal prompt. If the student responded correctly, the teacher confirmed the correctness of the response; if the student responded incorrectly, a physical prompt was provided.

### *Experimental Design*

A multiple probe design across three chained tasks and 3 students was used to measure observational learning. Each of the students received instruction on one task while the other students observed. Probe conditions were implemented before instruction and after criterion performance was established on each task.

### *Reliability*

Reliability data were collected on dependent measures and procedural fidelity (Billingsley, White, & Munson, 1980) at least twice during each experimental condition. A point-by-point method was used to calculate interobserver agreement percentages on dependent measures. Data were collected on the teacher's fidelity of implementing the following behaviors: (a) presenting the attentional cue, (b) having the materials ready, (c) providing the verbal cue, (d) waiting during the appropriate delay interval, (e) providing the correct prompt, (f) providing the correct consequence, and (g) providing verbal praise on the appropriate schedule. Procedural reliability was calculated by dividing the number of observed teacher behaviors in each category by the number of planned behaviors and multiplying by 100 (Billingsley et al., 1980).

Reliability observers included the third author, a full-time research associate, two other teachers who had participated in instructional research, and an undergraduate practicum student. All observers were experienced data collectors. They were given written and oral descriptions of the responses and definitions.

Reliability assessments occurred for 31.1% (milkshake), 32.1% (scrambled eggs), and 27.5% (pudding) of the probe sessions. Reliability assessments occurred for 55% (milkshake), 50% (scrambled eggs), and 60% (pudding) of the training sessions. During probes, the mean percentage of agreement on student responding during milkshake, scrambled eggs, and pudding sessions was 100% for Andrea and Alma; for Colin it was 100% for the milkshake and pudding tasks and 99.3% (range, 98% to 100%) for scrambled eggs. During training sessions, the mean percentage of agreement was 99% (range, 98% to 100%) for Alma (milkshake), 100% for Colin (scrambled eggs), and 99% (range, 98% to 100%) for Andrea (pudding).

Procedural reliability during probe sessions for all students was 100% for all teacher behaviors. Procedural reliability during training sessions for Alma (milkshake) was 100% for all behaviors except providing the appropriate prompt (99%, range, 98% to 100%) and providing verbal praise on the appropriate schedule (97.5%, range, 95% to 100%). For Colin (scrambled eggs), procedural reliability was 100% for all behaviors. For Andrea (pudding), procedural reliability was 100% for all behaviors except providing verbal praise on the appropriate schedule (97.5%, range, 95% to 100%) and providing appropriate consequences (99%, range, 98% to 100%).

## RESULTS

### *Acquisition of Directly Trained Skills*

The data for making milkshakes, scrambled eggs, and pudding are shown in Figures 1, 2, and 3, respectively. Probe data are graphed in two ways: (a) as the percentage of correct responses on all steps of the task analysis (including turning pages of the pictorial recipe books) and (b) as the percentage of correct responses on the critical steps of the task (excluding turning pages of the recipe books). Two responses are graphed for training conditions: correct anticipation responses and correct wait responses on all task steps.

Alma was directly taught to make a milkshake, and Colin and Andrea observed the instruction. Alma's percentage of correct responses for the last two sessions of Probe I on critical steps was 56% (Figure 1). Initiation of CTD training resulted in criterion level responding in 11 sessions. The mean session length was 15 min (range, 10.27 to 29.34).

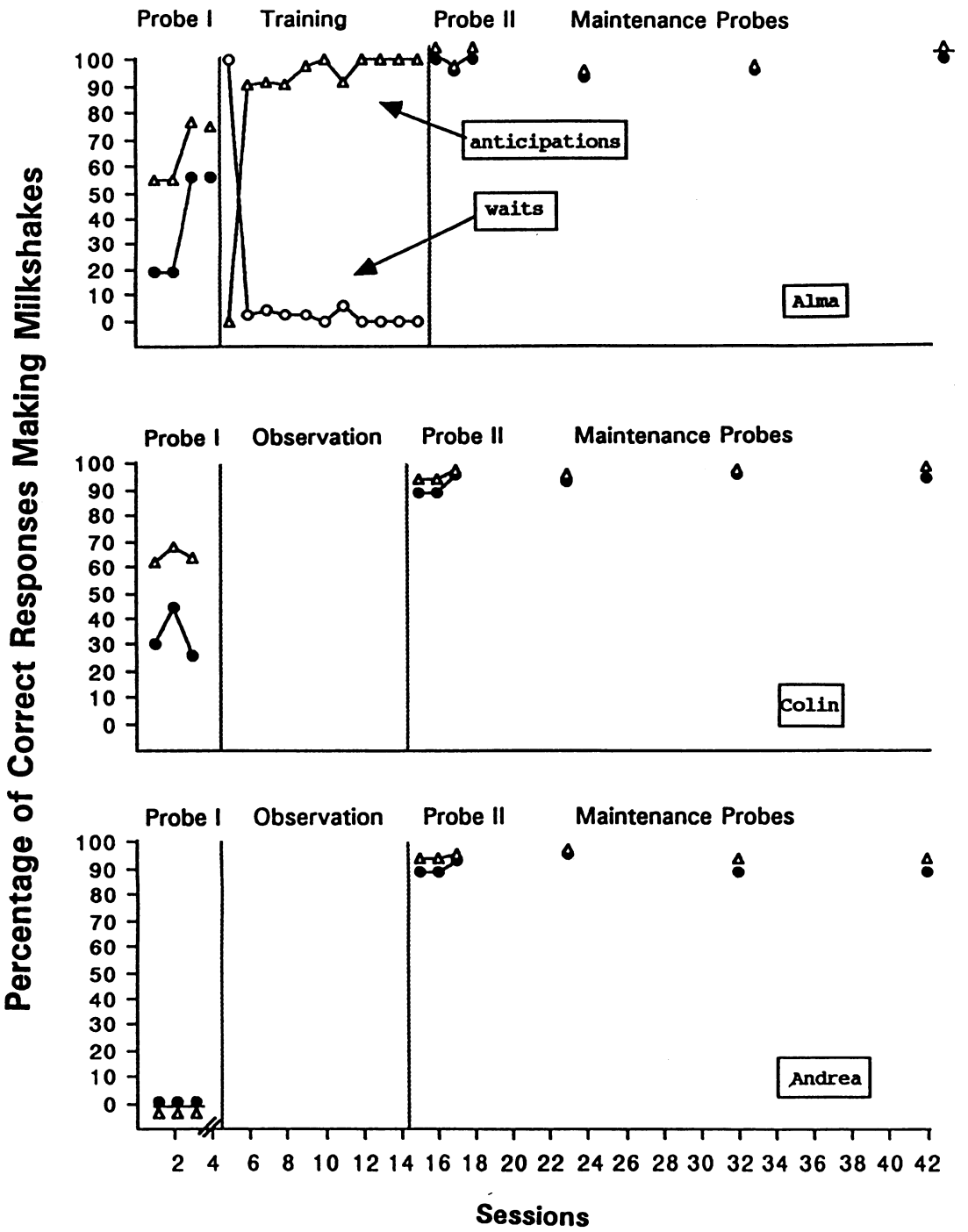


Figure 1. The percentage of correct responses for making a milkshake across experimental conditions for Alma (instructed student) is shown in the top graph; performance for Colin and Andrea (observing students) is shown in the middle and lower graphs, respectively. Scale breaks on the abscissa indicate absences of 1 to 7 days. Open triangles represent correct anticipations on all steps of the task analysis, closed circles represent correct anticipations on all steps excluding the page-turning steps, and open circles represent correct wait responses during training.

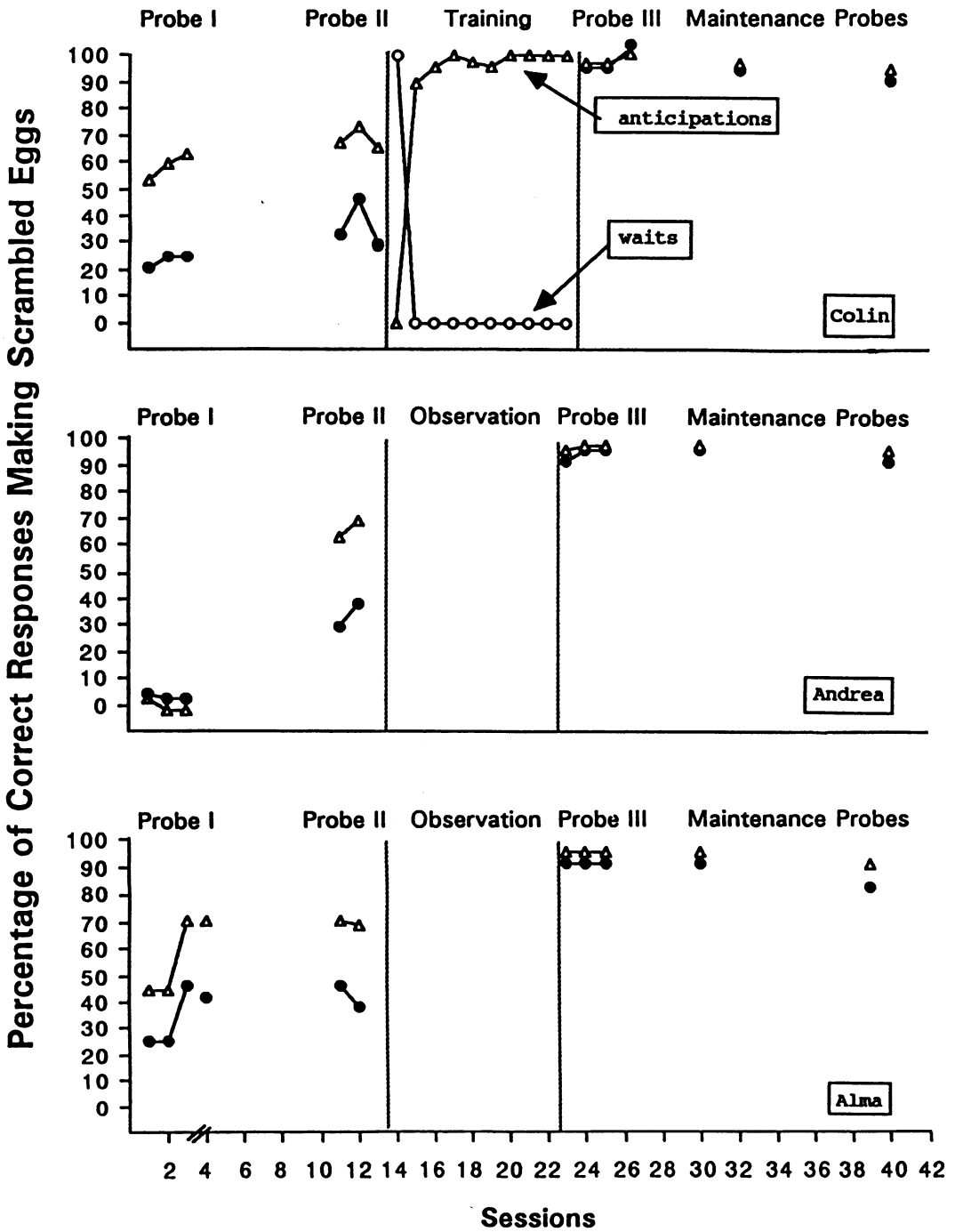


Figure 2. The percentage of correct responses for making scrambled eggs across experimental conditions for Colin (instructed student) is shown in the top graph; performance for Andrea and Alma (observing students) is shown in the middle and lower graphs, respectively. Scale breaks on the abscissa indicate absences of 1 to 7 days. Open triangles represent correct anticipations on all steps of the task analysis, closed circles represent correct anticipations on all steps excluding the page-turning steps, and open circles represent correct wait responses during training.

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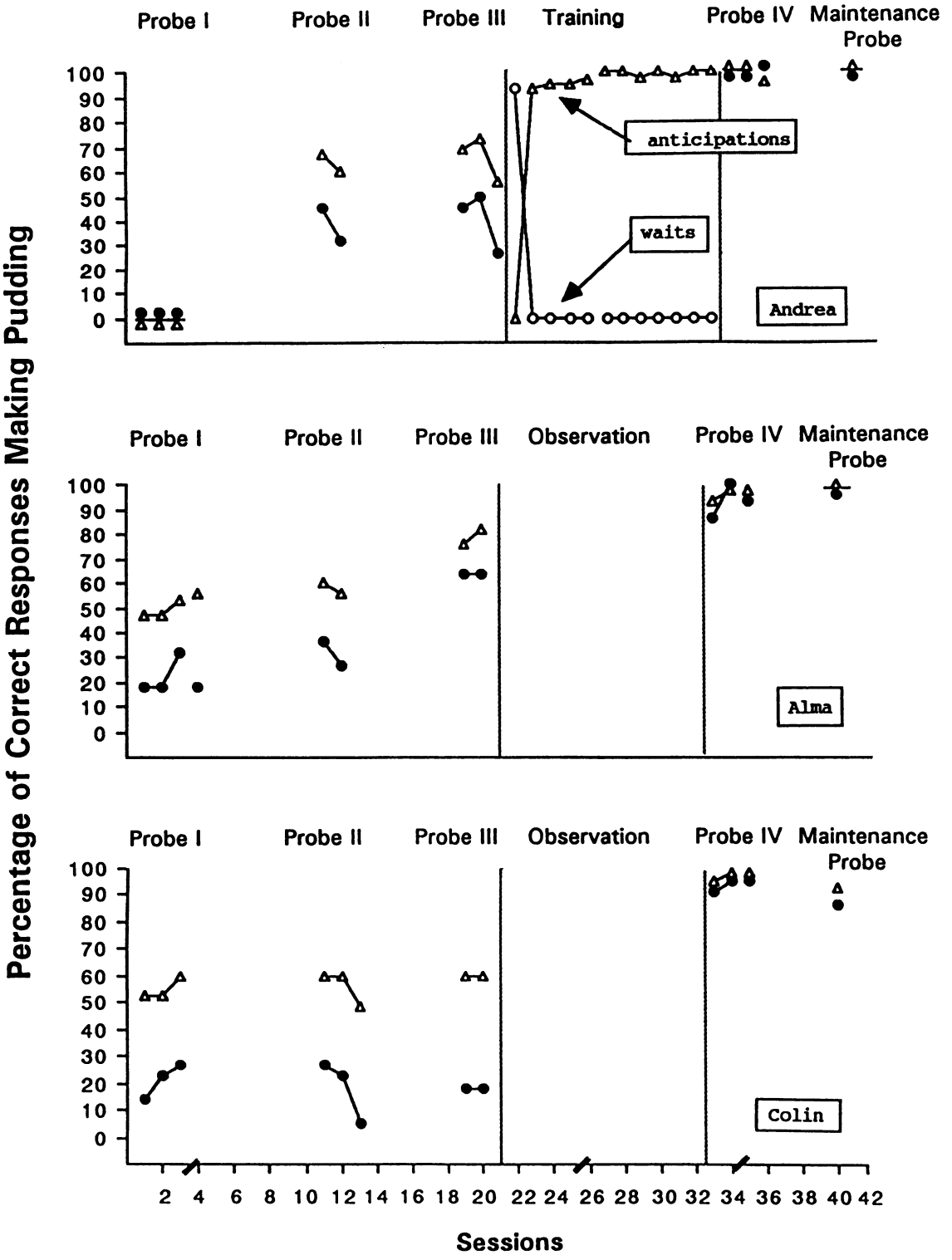
Figure 3. The percentage of correct responses for making pudding across experimental conditions for Andrea (instructed student) is shown in the top graph; performance for Alma and Colin (observing students) is shown in the middle and lower




graphs, respectively. Scale breaks on the abscissa indicate absences of 1 to 7 days. Open triangles represent correct anticipations on all steps of the task analysis, closed circles represent correct anticipations on all steps excluding the page-turning steps, and open circles represent correct wait responses during training.

Criterion level performance was maintained in Probe II (conducted immediately after training) and during maintenance probes (conducted 1, 3, and 5 weeks after Probe II). During training, Alma made 13 errors (2.2% of the trials); nine errors were topographical, three were duration, and one was a no-response error. All were nonwait errors.

Colin was directly taught to scramble eggs, and Andrea and Alma observed the instruction. Colin's performance during Probe I was stable between 21% and 25% correct (Figure 2). During Probe II, his performance ranged between 33% and 46% correct. Initiation of CTD training resulted in criterion level responding in 10 sessions. The mean session length was 17 min (range, 11.50 to 25.59). Criterion level performance continued during Probe III and during maintenance probes 1 and 3 weeks after Probe III. During training, Colin made 12 errors (2.4% of the trials); nine errors were topographical, two were duration, and one was a sequence error. Ten of Colin's errors were nonwait errors and two were wait errors.

Andrea was directly taught to make pudding, and Alma and Colin observed the instruction. Andrea performed at 0% correct during Probe I and between 27% and 50% correct during Probes II and III (Figure 3). Initiation of CTD training resulted in criterion level responding in 12 sessions. The mean session length was 11 min (range, 8.11 to 20.50). Criterion level performance continued during Probe IV and in a maintenance probe 1 week later. During training, Andrea made 13 errors (2.5% of the trials); six errors were topographical, six were duration, and one was a sequence error. Ten of Andrea's errors were nonwait errors and three were wait errors.

Thus, the CTD procedure was effective in teaching each student a chained snack preparation skill. Error percentages were low (2.4%), with the majority being nonwait topographical errors. Further, each student maintained high percentages of correct responses in the probe condition immediately following training and in maintenance probes.

### *Observational Learning*

The percentage of steps completed correctly (including and excluding the page-turning behavior) are also presented in Figures 1, 2, 3 for the tasks of milkshake, scrambled eggs, and pudding. Colin and Andrea served as observers while Alma was taught to make a milkshake. During Probe I, Colin's correct responding ranged between 26% and 44%, and Andrea's correct responses were all 0%. After Alma displayed criterion level responding, Colin and Andrea's performance was again measured (Probe II). Both Colin and Andrea performed at 89% or higher on critical steps in all sessions; this level of performance was maintained in probes 1, 3, and 5 weeks after Probe II.

Andrea and Alma served as observers while Colin was taught to make scrambled eggs. During Probe I, Andrea's correct responding ranged between 0% and 4%, and during Probe II her correct responding was 29% and 38%. During Probes I and II, Alma's correct responding ranged between 25% and 46%. After Colin displayed criterion level responding, Andrea and Alma's performance was assessed during Probe III. Both Andrea and Alma performed at 92% or higher on critical steps in all sessions. Andrea maintained this level of performance in probes 1 and 3 weeks after Probe III. Alma maintained this level at the 1-week probe and dropped to 83% at the 3-week probe.

Alma and Colin served as observers while Andrea was taught to make pudding. During Probes I and II, Alma's correct responding ranged between 18% and 36%, and during Probe III her correct responding was 64% in both sessions. During Probes I, II, and III, Colin's correct responding ranged between 5% and 27%. After Andrea displayed criterion level responding, Alma and Colin's performance was assessed in Probe IV. Alma performed above 86% correct on critical steps in all sessions and was at 100% correct 1 week later. Colin performed above 91% correct during Probe IV and dropped to 86% 1 week later.

## DISCUSSION

One purpose of this study was to assess the effectiveness of constant time delay in teaching chained responses to a triad of students with moderate mental retardation. The students did not perform at criterion levels on any task until training

was implemented. Each student was directly taught and learned one skill with constant time delay. This finding extends previous research (Schoen & Sivil, 1989; Wolery et al., 1991) that demonstrated that constant time delay was effective with chained tasks in dyads. Whether this finding would occur if group size were increased awaits empirical demonstration. It should be noted that the data in some baseline sessions were ascending. For example, correct performance on critical steps was ascending for Alma (Figure 1), Colin and Andrea (Figure 2), and Andrea and Alma (Figure 3). Three factors separately or in combination may have contributed to this pattern. First, some of the steps (other than the page-turning steps) of the task analyses were redundant; thus, generalization across tasks may have occurred. Second, the pictorial recipe books were used during probes and may have acquired stimulus control of students' correct responding. Third, students were reinforced for correct responses during probe conditions. This reinforcement was included to ensure that learning of instructed tasks was a result of the instructional procedures rather than reinforcement or reinforcement plus the instructional procedures. Despite the ascending preinstruction performance, no student achieved criterion performance before being instructed or until observing a peer being taught. Abrupt changes in the percentage of correct anticipations occurred when instruction was initiated.

A second purpose was to determine whether the 2 observers would acquire the chained task taught to their peer in the triad. Each observer learned to perform the critical steps above 85% correct without direct instruction and displayed high levels of correct performance in maintenance probes. This finding is consistent with previous research with dyads and extends it to triads. This level of observational learning means that students can be taught chained tasks in small groups (of at least 3 students) in which one instructional trial per session is presented to only 1 student. At least three advantages of such instruction exist. First, teaching in triads is a more efficient use of teacher time than teaching one-to-one or in dyads. Second, with skills that use consumable materials (such as cooking tasks), the expense of instruction can be minimized. As reported by Schuster et al. (1988), cooking instruction can be expensive because the materials are not reusable. (In the current investigation, the cost of foods was $63.86.) Third, teaching in triads allows teachers to provide instruction to several students on routines that occur naturally at low frequencies. For example, if the task is cleaning a sink, then it would naturally be dirty only once or twice per day. By teaching in a triad, the teacher does not have to make the sink dirty for each student needing instruction.

In this study, a number of variables were manipulated to facilitate observational learning: (a) The teacher prompted the instructed student at the beginning of a trial to direct the observers to watch him or her perform the task, (b) the teacher directed the instructed student to prompt the observers to turn the page of the pictorial recipe book, (c) the teacher praised the observers for watching the instruction and turning the pages of the pictorial recipe book, (d) the teacher prompted 1 observer to praise the instructed student at the completion of the chain and prompted the other observer to deliver a token to the instructed student, and (e) all students received tokens and were allowed to exchange those tokens for back-up reinforcers. It is not possible from the data collected in this study to assess the separate effects, if any, of these manipulations. Such effects should be the focus of subsequent research. In many instances, the students performed these skills without teacher direction. Subsequent research should evaluate whether students perform these interactive components without prompts in other chained instructional tasks.

Students' abilities and instructional histories may have influenced their performance in this study. All subjects were imitative and identified reinforcers were used with each. Clearly, observational learning would not be expected for subjects who were not imitative, and it is unlikely that the delay procedure would be effective without use of reinforcers. Further, the subjects in this study had experience learning discrete behaviors in small groups, experience learning chained tasks in one-to-one instructional arrangements, and experience with constant time delay; 2 subjects (Colin and Alma) had experience with learning chained tasks in dyads. The contri-

bution of these experiences to the outcome of this study cannot be assessed. However, one would expect the results to be most generalizable to students with this type of learning history and with the prerequisite skills displayed by these subjects.

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